

2, 4 and 5 have been amended for clarity, and new claims 6 and 7 have been added.

The rejection of claims 2-5 under 35 U.S.C. § 112, second paragraph is respectfully traversed. Without acquiescing in the rejection, claim 3 has been canceled without prejudice, and claims 2, 4 and 5 have been amended, thereby overcoming the rejection. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

The rejection of claims 1-5 under 35 U.S.C. § 112, first paragraph is respectfully traversed. The Office Action contends that the disclosure with respect to Figure 12 is confusing in that at page 14, lines 5-10 of the specification the heater is stated to have a narrow width, and a high resistive portion 315 at its proximal end. Thus, the Office Action alleges that the heater portion 315 is not shown in Figure 12 to have a narrow width, among other things.

Applicants respectfully disagree. As clearly stated at page 14, lines 9-10, the heater arrangement of the embodiment shown in Figure 12 is identical to the heater arrangement shown in Figure 4A except for the high resistive portion 315 being partly formed at the proximal side of the heat generating section 31 (indicated by a region "A"). As described at page 10, lines 17-24, the distal region A1 (*i.e.*, the lower section) of the heat generating section 31 is thin in width compared with the proximal region A2. The resistance value of the distal region A1 (*i.e.*,  $1.2\Omega$ ) is larger than that of the proximal region A2 (*i.e.*,  $1.0\Omega$ ). Thus, the

heater arrangement according to this embodiment of the present invention is characterized in that the high resistive portion is provided at each of the proximal side and the distal side of the heat generating section 31. The illustration in Figure 12 clearly shows the high resistive portions provided at both of the proximal end side and the distal end side of the heat generating section. The effect of partly providing the high resistive portion at the proximal side of the heat generating section 31 is clearly described at page 14, lines 16-25.

The Office Action further alleges that the last three lines of claim 5 is not understood. Claim 5 has been amended and is now believed to be entirely understandable. The Examiner's attention is further directed to page 6, line 26 to page 7, line 11 and page 8, line 15 to page 16, line 11. In particular, if the heat generating peak position exists within the  $\frac{3}{4}$  line segment region for a short duration less than one-fifth of the time required for the heat generating peak position to reach 900 °C, the activation of the gas sensing element will be delayed. Furthermore, if the heat generating peak position is offset toward the center of the heat generating pattern out of the  $\frac{3}{4}$  line segment region for more than one-fifth the time required to reach 900 °C, the activation of the gas sensing element will be delayed. Figure 13 shows the test data. Through such demonstrative tests, another embodiment of the present invention is characterized, as clearly described at page 15, lines 8-12, by the features that the heat generating peak position of the heater appears within  $\frac{3}{4}$  of a line segment extending between the distal end of the heat

generating pattern closer to the contact portion and the center of the heat generating pattern for more than one-fifth of a time required for the heat generating peak position of the heater to reach 900 °C.

Therefore, it is respectfully submitted that the application is in full compliance with the requirements of 35 U.S.C. § 112, and reconsideration and withdrawal of the rejections are respectfully requested.

With respect to Figure 4B, the Office Action indicates that if Figure 4B is the comparative example, it must be labeled as prior art. Applicants respectfully disagree. The Office Action provides no evidence that this figure is disclosed in any prior art document, or is admitted as prior art in the instant specification. As such, it is not believed that any such labeling of Figure 4B is necessary. However, for the sake of clarity, submitted herewith is a Request for Approval of Drawing Corrections labeling Figure 4B as a "Comparative Example." Approval is respectfully requested.

The rejection of claims 1, 3 and 5 under 35 U.S.C. § 102(a) over EP 899,562 (hereinafter "EP '562") is respectfully traversed. Without acquiescing in the rejection, it is noted that claims 1 and 3 have been canceled without prejudice, and that claim 5 has been amended for clarity. Accordingly, the rejection will be discussed with respect to the claims as amended.

Claim 5 specifically recites that a heat generating peak position of the heater appears within  $\frac{3}{4}$  of a line segment extending from a distal end of the heat

generating pattern closer to the contact portion to a center of the heat generating pattern for a time duration more than one-fifth of a time required for the heat generating peak position of the heater to reach 900 °C after the heater is activated.

EP '562 discloses that the heating part of the heating element has a heating sparse portion of a sparse heating distribution in part of the outer peripheral surface in the *circumferential direction* thereof (*see, e.g.*, col. 57, lines 41-43). There is no teaching or suggestion regarding the *axial position* of the heat generating peak position as claimed.

It is axiomatic that in order for a reference to anticipate a claim, the reference must disclose, teach or suggest each and every feature of the claim. As set forth above, EP '562 fails to disclose, teach or suggest each and every feature of the claimed invention. Therefore, EP '562 fails to anticipate the claimed invention. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

The rejection of claims 1-5 under 35 U.S.C. § 103(a) over EP '562 in view of Kojima et al. (U.S. Patent No. 5,895,591, hereinafter "Kojima") is respectfully traversed. Without acquiescing in the rejection, claims 1 and 3 have been canceled without prejudice, and claims 2, 4 and 5 have been amended for clarity. Accordingly, the rejection will be discussed with respect to the pending claims as amended.

Claim 2 specifically recites that the electric resistive value of the heat generating section is maximized in the vicinity of a contact portion where the heater is brought into contact with an inside surface of the reference gas chamber.

Neither EP '562 nor Kojima, either singly or in combination, disclose, teach or suggest the claimed arrangement wherein the electric resistive value of the heat generating section is maximized in the vicinity of the contact portion.

In particular, EP '562 merely discloses that an oxygen sensing element is brought into contact with a portion other than the region where the generated heat distribution is sparse (*i.e.*, not dense). Furthermore, EP '562 fails to disclose or suggest anything about the electric resistance.

Kojima merely discloses an arrangement in which the width of a heater pattern is locally changed. Additionally, Kojima fails to disclose or suggest the contact portion.

Claim 4 recites that a heat generating peak position of said heater is in the vicinity of said contact portion, and that heat generating section has a high resistive portion provided at a proximal end side thereof. Neither EP '562 nor Kojima disclose or suggest these specifically recited features.

Claim 5 specifically recites that a heat generating peak position of the heater appears within  $\frac{3}{4}$  of a line segment extending from a distal end of the heat generating pattern closer to the contact portion to a center of the heat generating

pattern for a time duration more than one-fifth of a time required for the heat generating peak position of the heater to reach 900 °C after the heater is activated.

EP '562 discloses that the heating part of the heating element has a heating sparse portion of a sparse heating distribution in part of the outer peripheral surface in the *circumferential direction* thereof (*see, e.g.*, col. 57, lines 41-43). There is no teaching or suggestion regarding the *axial position* of the heat generating peak position as claimed.

Kojima fails to overcome this fundamental deficiency of EP '562, and, as set forth above, merely discloses an arrangement in which the width of a heater pattern is locally changed, and discloses nothing about the heat generating peak position.

Therefore, even if, *arguendo*, the combination of EP '562 and Kojima were proper, the combination nevertheless fails to render the claimed invention obvious. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

The rejection of claims 1 and 5 under 35 U.S.C. § 102(b) over JP 5-126789 (hereinafter "JP '789") is respectfully traversed. Without acquiescing in the rejection, claim 1 has been canceled without prejudice and claim 5 has been amended for clarity. Accordingly, the rejection will be discussed with respect to claim 5 as amended.

JP '789 discloses an arrangement in which a heat-generating maximum temperature portion of a heater is positioned so as to agree with a portion where an external electrode is provided. JP '789 fails to disclose or suggest the specific positional relationship in the axial direction, as set forth in claim 5, between the heat generating peak position and the heat generating pattern in a warm up operation of the heater. Therefore, JP '789 fails to disclose, teach or suggest each and every feature of the claimed invention, and thus fails to anticipate the claimed invention. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

The rejection of claims 1-5 under 35 U.S.C. § 103(a) over JP '789 in view of EP '562 and Kojima is respectfully traversed. Without acquiescing in the rejection, claims 1 and 3 have been canceled without prejudice, and claims 2, 4 and 5 have been amended for clarity. Accordingly, the rejection will be discussed with respect to the claims as amended.

As set forth above, each of the cited references are fundamentally deficient in numerous respects. Therefore, even if, *arguendo*, the combination of JP '789, EP '562 and Kojima were proper, the combination nevertheless fails to render the claimed invention obvious. In particular, none of the references, either singly or in combination disclose, teach or suggest the features of the claimed invention. For example, the combination of references fails to disclose or suggest an arrangement in which the electric resistive value of the heat generating section is maximized in

FUKAYA et al  
Serial No.: 09/774,650

the vicinity of the contact portion, or the feature of specifying the axial position of the heat generating peak position with respect to the claimed region, i.e.,  $\frac{3}{4}$  of a line segment axially extending from the distal end of the heat generating pattern to the center of the heat generating pattern. Thus, the proposed combination of references fails to render the claimed invention obvious. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

In view of the foregoing, it is respectfully submitted that the entire application is in condition for allowance. Favorable reconsideration of the application and prompt allowance of the claims are earnestly solicited.

Should the Examiner deem that further issues require resolution prior to allowance, the Examiner is invited to contact the undersigned attorney of record at the telephone number set forth below.

Respectfully submitted,

**NIXON & VANDERHYE P.C.**

By: \_\_\_\_\_

  
Updeep S. Gill  
Reg. No. 37,334

USG:dbp  
1100 North Glebe Road, 8th Floor  
Arlington, VA 22201-4714  
Telephone: (703) 816-4000  
Facsimile: (703) 816-4100

**MARKED-UP VERSION OF THE SPECIFICATION AMENDMENTS**

Paragraph at page 9, lines 17-22:

The contact portion 30, as apparent from Fig. 1, is an annular periphery of the heater 3 along which a distal end of the heater 3 is brought into contact with the inside surface of the reference gas chamber 100 at a portion closer to the bottom of the reference gas chamber 100. As shown in Fig. 1, a porous protective layer [12] 13 covers an outside surface of the measured gas sensing electrode 12 of the gas sensing element 1.

Paragraph at page 10, lines 17-24:

The heat generating section 31 is indicated by a region "A" in Fig. 4A. The region "A" includes a distal region A1 and a proximal region A2. Both of the distal region A1 and the proximal region A2 are made of a W-Re alloy. The distal region A1 is thin in width compared with the proximal region A2. A resistance value of the distal region A1 is  $1.2\Omega$ . A resistance value of the proximal region [A1] A2 is  $1.0\Omega$ . Both of the distal region A1 and the proximal region A2 have the same axial length of 3mm. In Fig. 4A, the contact portion 30 of the heater 3 is encircled by a dotted line.

**MARKED-UP VERSION OF THE AMENDED CLAIMS**

2. *(Amended)* A gas sensor comprising:
- a gas sensing element including a cup-shaped cylindrical solid electrolytic element having a reference gas chamber defined therein, a measured gas sensing electrode provided on an outer surface of said solid electrolytic element, and a reference gas sensing electrode provided on an outer surface of said solid electrolytic element facing said reference gas chamber, and
- a heater accommodated in said reference gas chamber,
- wherein said heater has a heat generating section for generating heat in response to electric power supplied thereto, and
- an electric resistive value of said heat generating section is maximized in the vicinity of a contact portion where said heater is brought into [said gas sensing element] contact with an inside surface of said reference gas  
chamber.
4. *(Amended)* A gas sensor comprising:
- a gas sensing element including a cup-shaped cylindrical solid electrolytic element having a reference gas chamber defined therein, a measured gas sensing electrode provided on an outer surface of said solid electrolytic element, and a reference gas sensing electrode provided on an inner surface of said solid electrolytic element facing said reference gas chamber, and

a heater accommodated in said reference gas chamber,

wherein a contact portion is provided on an outer cylindrical surface of said heater so that said contact portion is brought into contact with an inside surface of said reference gas chamber,

a heat generating peak position of said heater being in the vicinity of said contact portion,

said heater [has] having a heat generating section for generating heat in response to electric power supplied thereto, and

said heat generating section has a high resistive portion provided [closer to] at a proximal end side thereof [of the gas sensor].

5. *(Amended)* A gas sensor comprising:

a gas sensing element including a cup-shaped cylindrical solid electrolytic element having a reference gas chamber defined therein, a measured gas sensing electrode provided on an outer surface of said solid electrolytic element, and a reference gas sensing electrode provided on an inner surface of said solid electrolytic element facing said reference gas chamber, and

a heater accommodated in said reference gas chamber,

wherein said heater has a heat generating [section] pattern for generating heat in response to electric power supplied thereto,

a contact portion is provided on an outer cylindrical surface of said heater so that said contact portion is brought into contact with ~~any~~<sup>the</sup> inside surface of ~~said reference gas chamber~~, and

a heat generating peak position of said heater appears within 3/4 of a line segment axially extending [between] from a distal end of [a] said heat generating pattern closer to said contact portion [and] to a center of said heat generating pattern for a time duration more than one fifth of a time required for the heat generating peak position of the heater to reach 900 °C after said heater is activated.

**NEWLY ADDED CLAIMS**

6. (New) A gas sensor comprising:
- a gas sensing element including a cup-shaped cylindrical solid electrolytic element having a reference gas chamber defined therein, a measured gas sensing electrode provided on an outer surface of said solid electrolytic element, and a reference gas sensing electrode provided on an inner surface of said solid electrolytic element facing said reference gas chamber, and
- a heater accommodated in said reference gas chamber,
- wherein a contact portion is provided on an outer cylindrical surface of said heater so that said contact portion is brought into contact with an inside surface of said reference gas chamber,
- a heat generating peak position of said heater is in the vicinity of said contact portion,
- said heater has a heat generating section for generating heat in response to electric power supplied thereto, and
- said heat generating section has a high resistive portion at a distal side thereof.

7. (New) A gas sensor comprising:
- a gas sensing element including a cup-shaped cylindrical solid electrolytic element having a reference gas chamber defined therein, a measured

gas sensing electrode provided on an outer surface of said solid electrolytic element, and a reference gas sensing electrode provided on an inner surface of said solid electrolytic element facing said reference gas chamber, and

a heater accommodated in said reference gas chamber,

wherein a contact portion is provided on an outer cylindrical surface of said heater so that said contact portion is brought into contact with an inside surface of said reference gas chamber,

a heat generating peak position of said heater is in the vicinity of said contact portion,

said heater has a heat generating section for generating heat in response to electric power supplied thereto, and

said heat generating section has a high resistive portion at a distal end side thereof and another high resistive portion at a proximal end side thereof.

**MARKED-UP VERSION OF THE SPECIFICATION AMENDMENTS**

Paragraph at page 9, lines 17-22:

The contact portion 30, as apparent from Fig. 1, is an annular periphery of the heater 3 along which a distal end of the heater 3 is brought into contact with the inside surface of the reference gas chamber 100 at a portion closer to the bottom of the reference gas chamber 100. As shown in Fig. 1, a porous protective layer [12] 13 covers an outside surface of the measured gas sensing electrode 12 of the gas sensing element 1.

Paragraph at page 10, lines 17-24:

The heat generating section 31 is indicated by a region "A" in Fig. 4A. The region "A" includes a distal region A1 and a proximal region A2. Both of the distal region A1 and the proximal region A2 are made of a W-Re alloy. The distal region A1 is thin in width compared with the proximal region A2. A resistance value of the distal region A1 is  $1.2\Omega$ . A resistance value of the proximal region [A1] A2 is  $1.0\Omega$ . Both of the distal region A1 and the proximal region A2 have the same axial length of 3mm. In Fig. 4A, the contact portion 30 of the heater 3 is encircled by a dotted line.

**MARKED-UP VERSION OF THE AMENDED CLAIMS**

2. *(Amended)* A gas sensor comprising:

a gas sensing element including a cup-shaped cylindrical solid electrolytic element having a reference gas chamber defined therein, a measured gas sensing electrode provided on an outer surface of said solid electrolytic element, and a reference gas sensing electrode provided on an outer surface of said solid electrolytic element facing said reference gas chamber, and

a heater accommodated in said reference gas chamber,

wherein said heater has a heat generating section for generating heat in response to electric power supplied thereto, and

an electric resistive value of said heat generating section is maximized in the vicinity of a contact portion where said heater is brought into [said gas sensing element] contact with an inside surface of said reference gas chamber.

4. *(Amended)* A gas sensor comprising:

a gas sensing element including a cup-shaped cylindrical solid electrolytic element having a reference gas chamber defined therein, a measured gas sensing electrode provided on an outer surface of said solid electrolytic element, and a reference gas sensing electrode provided on an inner surface of said solid electrolytic element facing said reference gas chamber, and

a heater accommodated in said reference gas chamber,

wherein a contact portion is provided on an outer cylindrical surface of said heater so that said contact portion is brought into contact with an inside surface of said reference gas chamber,

a heat generating peak position of said heater being in the vicinity of said contact portion,

said heater [has] having a heat generating section for generating heat in response to electric power supplied thereto, and

said heat generating section has a high resistive portion provided [closer to] at a proximal end side thereof [of the gas sensor].

5. *(Amended)* A gas sensor comprising:

a gas sensing element including a cup-shaped cylindrical solid electrolytic element having a reference gas chamber defined therein, a measured gas sensing electrode provided on an outer surface of said solid electrolytic element, and a reference gas sensing electrode provided on an inner surface of said solid electrolytic element facing said reference gas chamber, and

a heater accommodated in said reference gas chamber,

wherein said heater has a heat generating [section] pattern for generating heat in response to electric power supplied thereto,

a contact portion is provided on an outer cylindrical surface of said heater so that said contact portion is brought into contact with an inside surface of said reference gas chamber, and

a heat generating peak position of said heater appears within 3/4 of a line segment axially extending [between] from a distal end of [a] said heat generating pattern closer to said contact portion [and] to a center of said heat generating pattern for a time duration more than one fifth of a time required for the heat generating peak position of the heater to reach 900 °C after said heater is activated.

NEWLY ADDED CLAIMS

6. (New) A gas sensor comprising:

a gas sensing element including a cup-shaped cylindrical solid electrolytic element having a reference gas chamber defined therein, a measured gas sensing electrode provided on an outer surface of said solid electrolytic element, and a reference gas sensing electrode provided on an inner surface of said solid electrolytic element facing said reference gas chamber, and

a heater accommodated in said reference gas chamber,

wherein a contact portion is provided on an outer cylindrical surface of said heater so that said contact portion is brought into contact with an inside surface of said reference gas chamber,

a heat generating peak position of said heater is in the vicinity of said contact portion,

said heater has a heat generating section for generating heat in response to electric power supplied thereto, and

said heat generating section has a high resistive portion at a distal side thereof.

7. (New) A gas sensor comprising:

a gas sensing element including a cup-shaped cylindrical solid electrolytic element having a reference gas chamber defined therein, a measured

gas sensing electrode provided on an outer surface of said solid electrolytic element, and a reference gas sensing electrode provided on an inner surface of said solid electrolytic element facing said reference gas chamber, and

a heater accommodated in said reference gas chamber,

wherein a contact portion is provided on an outer cylindrical surface of said heater so that said contact portion is brought into contact with an inside surface of said reference gas chamber,

a heat generating peak position of said heater is in the vicinity of said contact portion,

said heater has a heat generating section for generating heat in response to electric power supplied thereto, and

said heat generating section has a high resistive portion at a distal end side thereof and another high resistive portion at a proximal end side thereof.